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THE SCOPE OF SOME SENTENCE  
ADVERBS AND SURFACE STRUCTURE\*

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In this paper I discuss the syntax and semantics of the sentence adverbs *still*, *again*, *anymore*, and *yet*. There are two facts about the semantics of these adverbs which I have tried to capture. The first is that the scope of the adverb with respect to negation is predictable from the surface order of the adverbs and the negative element. The second involves the notion of conventional implicature (or presupposition) in the sense of Karttunen and Peters (1975, to appear). The claim is made that the adverbs analysed here differ from adverbs like *usually*, *always*, and *necessarily* in that the former contribute only to the conventional implicatures of sentences while the latter contribute to the truth-conditional aspect of their meanings. I discuss informally the facts that I wish to capture and then present some rules which show how they might be captured in a Karttunen-Peters semantics for a transformational grammar.

An important preliminary notion is the idea of the scope of the adverb. To say that these adverbs are sentence adverbs is to say that syntactically they are immediately dominated by the S node and that semantically they have the meaning of a sentence in their scope. In (1a) *necessarily* has 'a Fiat is reliable' in its

- (1) a. A Fiat is necessarily reliable
- b. A Fiat isn't necessarily reliable
- c. A Fiat necessarily isn't reliable
- d. Necessarily a Fiat isn't reliable
- e. A Fiat isn't reliable necessarily

scope. By making sentence adverbs the same semantic type as logical sentence operators like negation and modals, we can have sentences which differ in meaning only by having different relative scopes for these operators in logical form. If we consider negative sentences like (1b-c) we find that their meanings differ in just this way. (1b) gives the adverb *necessarily* narrow scope with respect to the negation, and (1c) gives it wide scope. The semantic scope of the two words reflects their surface order: the element to the right has narrower scope.

If we look at the adverb in sentence initial position as in (1d) we find that it has wide scope, as would be expected. In sentence final position, however, the simple generalization does not hold. (1e) is ambiguous. It can mean either (1b) (the narrow scope reading the left-to-right rule would predict) or (1c) (a wide scope reading). The ambiguity in speech is usually resolved

by making a pause and an intonational break just before the sentence final wide scope adverb.

*Always* and *usually* in (2) show the same pattern. (The glosses are meant to informally represent the meanings.) The im-

- (2)a. John  $\left\{ \begin{smallmatrix} \text{always} \\ \text{usually} \end{smallmatrix} \right\}$  does his homework

'On  $\left\{ \begin{smallmatrix} \text{all} \\ \text{most} \end{smallmatrix} \right\}$  appropriate occasions John does his homework'

- b. John doesn't  $\left\{ \begin{smallmatrix} \text{always} \\ \text{usually} \end{smallmatrix} \right\}$  do his homework

'On fewer than  $\left\{ \begin{smallmatrix} \text{all} \\ \text{most} \end{smallmatrix} \right\}$  appropriate occasions, John does his homework'

- c. John  $\left\{ \begin{smallmatrix} \text{always} \\ \text{usually} \end{smallmatrix} \right\}$  doesn't do his homework

'On  $\left\{ \begin{smallmatrix} \text{all} \\ \text{most} \end{smallmatrix} \right\}$  appropriate occasions, John doesn't do his homework'

portant thing to note here is that (2a-c) each have a different meaning. (2b) is what would be expected from the wide scope negation with the adverb in its scope. In (2c) the negation is inside the scope of the adverb.

The correlation between surface order and logical scope of negation and adverb can be captured by rules which assign the leftmost operator the widest scope, with the exception that the sentence final adverb position with intonation break could also be a wide scope position. But consider the sentences of (3) and (4) with the adverbs *again* and *still*. Even though the (b) sentence is

- (3)a. Cathy bid hearts again

'Cathy bid hearts and once before she bid hearts'

- b. Cathy didn't bid hearts again

'Cathy didn't bid hearts and once before she did'

- c. Cathy didn't bid hearts, again

'Cathy didn't bid hearts and once before she didn't'

- (4)a. The keg is still full

'The keg is full and over some past interval it has been full'

- b. The keg isn't still full

'The keg isn't full and over some past interval it was full'

- c. The keg still isn't full

'The keg isn't full and over some past interval it hasn't been full'

the negation of the (a) sentence, the two share a part of their meaning: the second conjunct of the gloss which is the part of the meaning contributed by the adverb. The meaning contributed by the adverb remains constant under negation from (a) to (b), even though the generalization stated above would lead us to expect that the adverb is within the scope of the negation. Comparing the (b) and (c) sentences which should differ only with respect to the relative scopes of the adverb and the negation, we find that they also share a conjunct of their meanings, but this time it is the first conjunct which is the same, both being negations. The meanings contributed by the adverbs differ with respect to the scope of negation. In (c) the second conjunct does have negation within the scope of the adverb, but rather than the negation having wide scope in (b), it is missing. The negation doesn't affect the meaning of the adverb in (3-4) where it has wide scope.

The generalization about the correlation between scope and surface order can be preserved in light of the differences between the adverbs of (1-2) and (3-4) by saying that for *still* and *again* wide scope negation doesn't affect what they contribute to the sentence's meaning. To do this I have chosen to cast this analysis in a semantics which makes a distinction between two types of meaning: assertion and conventional implicature (or presupposition). Only the former type of meaning is affected by negation. Conventional implicature remains constant under negation.

Briefly, the Karttunen-Peters semantics used here is an extension of Montague's semantic theory that takes into account some aspects of non-truth-conditional meaning by modifying the translation procedure of Montague 1974 so that it associates with each derivation of an expression of English an ordered pair of expressions of Intensional Logic. The first member of the pair, the extension expression, represents the assertion expressed by the sentence. The second expression, the implicature expression, represents what the sentence conventionally implicates (what the speaker is committed to over and above the assertion). Throughout the rest of this paper I shall mean conventional rather than conversational implicature when I simply say "implicature". It should be stressed that both aspects are part of the meaning of the sentence, but they differ most importantly for their use here in that implicatures remain constant under negation.<sup>1</sup>

So the first conjunct of the glosses of (3-4) represents the assertion of the sentences and the second conjunct, the implicatures. The glosses of (2) are just assertion. Although the adverbs of (1-2) are not treated here, the rules that I have given will provide interpretations for them if their meanings contribute to the assertion rather than (or in addition to) the implicatures of sentences which contain them.

Section 1 presents a syntactic and translation rule for sentence adverbs and illustrates how the differences among the sentences of (3-4) are captured. Section 2 discusses the negative polarity adverbs *anymore* and *yet* and section 3 shows how this analysis represents the difference between the so-called "positive *anymore*" dialects and standard dialects.

1. To illustrate how these scope relations can be represented consider the PS rule (5). Its translation rule (6) specifies how the doublets which represent the meanings of sentences are to be built up from the meanings of their components. (Throughout this paper I shall simply present translations associated with sentences rather than entire derivations.) It is the effect of this

$$(5) S \rightarrow (ADV_w) NP (ADV_w) Tns (not) (ADV_n) VP (ADV_n) (ADV_w)^2$$

$$(6) S \rightarrow Tns (^{ADV_w} (^{not} (^{ADV_n} (^{NP} (^{VP}))))))$$

translation rule to assign the adverb either wide or narrow scope with respect to negation in the AUX depending upon its position.

The ambiguity of the final position is usually disambiguated by intonation. Lasnik 1972 discusses this in regard to the ambiguity in (7). (7a) means 'It is not the case that Sen. Eastland grows cotton to make money'. (7b) means 'in order to make money, he doesn't grow cotton'. I consider the ambiguity of (8) to result from the same scope difference. Unlike (7), however, (8) asserts the same thing on both readings because *again* contributes only to implicature. In (7) 'to make money' is a complex adverb whose meaning is part of the sentence's assertion. Hence in (7a) Sen. Eastland may or may not grow cotton, but in (7b) he clearly doesn't grow cotton. (8a) will receive two readings, depending

(7)a. Sen. Eastland doesn't grow cotton to make money

b. Sen. Eastland doesn't grow cotton, to make money

(8)a. *Cathy didn't bid again*

b.  $\langle \text{PAST} \neg \text{bid}^e(^c); \text{PAST} [\text{ONCE-BEFORE} \text{bid}^e(^c)] \rangle$

c.  $\langle \text{PAST} \neg \text{bid}^e(^c); \text{PAST} [\text{ONCE-BEFORE} \neg \text{bid}^e(^c)] \rangle$

upon whether *again* receives wide or narrow scope. If *again* receives narrow scope, as in (8b), the sentence asserts that at some (unspecified) earlier time it was not the case that Cathy bid and implicates that at least once before she did bid. . . . On the wide scope reading (8c) the assertion is the same but the implicature is that at least once before she didn't bid. The meaning of *again* then is to implicate that the sentence in its scope has been true at least once before. The difference in implicature between

is unambiguous.<sup>3</sup>

from a point in the past through the reference time. While again

- ( $P_i$  is a past interval operator)

- (11) a. *Still John isn't here*

- b. John isn't here, still  $\langle \neg \text{here}^e(\hat{j}); \text{Pi} \neg \text{here}^e(\hat{j}) \rangle$

- c. John still isn't here

- d. John isn't still here

'John isn't here anymore'.

syntactic structure of the sentence.

for sentences which contain them.

good effect of predicting that negative polarity adverbs can

appear pre-AUX if the conditioning negation is in the subject NP as in (12). (I assume that these subject NPs are quantified in and hence receive wider scope than that accorded the NP in (6) by rules equivalent to Montague's quantification rules).

- (12)a. *No one yet has solved this puzzle*  
 b. *Few people anymore will take the time to bake bread*

What does (13a) mean? It asserts that John isn't here and implicates that over some interval in the past, John was here. Since *anymore* takes only narrow scope with respect to the negation, the sentence within its scope is 'John is here'. Hence we can assign *anymore* the same meaning as *still*, represented in Intensional Logic as (13b). I have analysed *yet* as in (13c), implicating that over some past interval John hasn't been here and it has been expected that he would be here.<sup>5</sup> Hence (14a) has

- (13)a. *John isn't here anymore*  $\langle \neg \text{here}^e(^j); \text{Pi } \text{here}^e(^j) \rangle$   
 b. *anymore*  $\Rightarrow \langle \lambda p^v p; \lambda p \text{ Pi } ^v p \rangle$   
 c. *yet*  $\Rightarrow \langle \lambda p^v p; \lambda p [\text{Pi}^v p \wedge H \text{ expected } (^w p)] \rangle$   
 (14)a. *John isn't here yet*  $\langle \neg \text{here}^e(^j); \text{Pi } \neg \text{here}^e(^j) \wedge H \text{ expected } (^w \text{ here } (^j)) \rangle$   
 b. *The Dean still isn't here*  
 c. *The Dean isn't here yet*

the indicated translation, since *yet* takes 'John is here' as its scope (the meaning of the rest of the sentence minus the negation). *Yet* differs from *still* principally in the expectation implicature. In many contexts sentences with *still not* conversationally implicate that some change is expected, but *yet* conventionally implicates it always. If a student drops by the Dean's office and asks to see the Dean on a day when the Dean is out of town, leaves, and then returns later in the day to ask the same secretary if the Dean is in, the secretary may say (14b), but it would be more than misleading to say (14c), since it conventionally implicates that the Dean is expected in.

3. To this point I have discussed scope interactions between the adverbs and explicit auxiliary negation only. The class of words which allow negative polarity words to appear in sentences is difficult to specify. Apart from a few cases of covert negation words like those underlined in (15a-c), there is wide variation in the sentences which speakers will accept. I wish to use this fact to suggest an account for why such an item as the so-called positive-*anymore* of (16) should exist and how its meaning is related to that of negative polarity *anymore*.

- (17)a. *Few people are here anymore*  
 b. Only *John is here anymore*  
 c. *John rarely attends class anymore*  
 d. *John seldom attends class anymore*

(16) *Calculators are cheap anymore*

Since the negative polarity properties of *any* and *yet* are represented by the same thing, the global restriction that they appear with narrow scope to a negation, we should expect that if a certain covert negation word enables one to appear in a sentence it enables the other to. Since *any* is synonymous with (narrow scope) *still*, we should expect any sentence with *any* to have a paraphrase with *still*. The predictions which follow from these two tests are borne out by the sentences in (15). For each sentence of (15) there is a grammatical sentence with *yet* in place of *any*. The sentences of (17) have readings synonymous with their pair in (15).

- (17)a. *Few people are still here*  
 b. *Only John is still here*  
 c. *?John rarely still attends class*  
 d. *?John seldom still attends class*
- (18)a. *It's hard to do that anymore*  
 b. *That's all he ever does anymore*  
 c. *All I seem to do anymore is knit*

There are, however, some sentences with *any* which fail these tests. They represent *any* stretched to its limit. Hindel 1975 reports (and I have found as well) wide variation in the acceptability of the sentences in (18) by speakers of the standard dialect. Presumably they are acceptable to some speakers who think of *hard* as *not easy* and of the *all* in (18b,c) as *the only thing*. There is no such variation among speakers of positive *any* dialects. The sentences of (19) are all fine examples of positive *any*.

Though speakers of standard dialects typically have great difficulty in interpreting positive *any* sentences, the meanings of the two lexical items are quite similar. Given with each sentence in (19) is an approximation of the translation I would give for them.

- (19)a. *We eat a lot of fish anymore*  
 Asserts: *We eat a lot of fish*  
 Implicates:  $Pi \neg$  *We eat a lot of fish*
- b. *Calculators are cheap anymore*  
 Asserts: *Calculators are cheap*  
 Implicates:  $Pi \neg$  *Calculators are cheap*
- c. *Any more John doesn't eat fish*  
 Asserts: *John doesn't eat fish*  
 Implicates:  $Pi \neg$  *John doesn't eat fish* = *Pi John eats fish*



As can be seen in (19c), "positive *anymore*" is somewhat misnamed. It is actually a wide-scope *anymore* (hereafter *anymore<sub>w</sub>*) which forms the missing mate for *anymore<sub>n</sub>*, the polarity item. *Anymore<sub>w</sub>* receives the translation (20) as opposed to *anymore<sub>n</sub>* in (22).

(20) *anymore<sub>w</sub>*  $\rightarrow \lambda p \forall p_i \lambda p \text{ Pi} \neg p$

(21) *anymore<sub>n</sub>*  $\rightarrow \lambda p \forall p_i \lambda p \text{ Pi} \forall p$

The similarity of the meanings of these two items has been noted before (Horn 1970, Hindel and Sag 1975). The problem has been to account for the similarity without making the prediction that positive *anymore* means the same thing as negative polarity *anymore*. Rather than consider the two words the same lexical item, and the difference between the two dialects as simply the loss of a restriction to negative environments, I would like to describe the two items as separate lexical items, the product of a restructuring rather than an extension of one word through the loss of a restriction.

I think that there are three types of *anymore* dialect. The two main types are the conservative *anymore<sub>n</sub>* speakers and the innovating speakers with *anymore<sub>w</sub>*, also. There is a third group of speakers that get some extra sentences by extending the class of covert negation words, but for *anymore* only (the dialects which accept (18) but not (16)). It is this center group that have a single lexical item represented by *anymore<sub>n</sub>*, and (in some way) a set of expressions closely related to them which are ripe for restructuring into *anymore<sub>w</sub>*. Any speaker trying to account for the meaning of *anymore* in (18) has two choices. Either he creates a new lexical item, or derives these via the old lexical item and some semantic work. Any speaker who is also trying to account for sentences like (16) will always take the first choice, incorporating those cases of extended *anymore<sub>n</sub>* as the *anymore<sub>w</sub>* needed for sentences like (16). The chart in (22) is meant to represent the situation. The sentences progress from overt through increasingly covert to no negation.

The existence of individual variation in the center range does not render the hypothesis vacuous. It presumes that an individual speaker of a conservative dialect will accept a continuum of sentences with *anymore* on a covert negation scale. Those speakers who accept sentences lower down on the scale are more likely to be able to interpret *anymore<sub>w</sub>* correctly. It seems to me that the data in Hindel and Sag are consistent with this hypothesis, though they also show that the syntactic pattern or a sentence has a lot to do with acceptability judgments.

The fact that *anymore<sub>w</sub>* has no negative polarity restriction automatically predicts that positive *anymore* can (but not necessarily will) appear sentence initially.

(22)

	appears in SE	generic scope by skill	Context adverb	implying adverb
a. <u>John doesn't have the book anymore</u>	✓	✓		
b. <u>No one has the book anymore</u>	✓	✓		
c. <u>Not many people are here anymore</u>	✓	✓		
d. <u>Few people are here anymore</u>	✓	✓		
e. <u>Only Mary likes John anymore</u>	✓	✓		
f. <u>John rarely attends class anymore</u>	✓	?		
g. <u>John seldom attends class anymore</u>	✓	?		
h. <u>All I seem to do anymore is knit</u> <u>(?All I seem to do still is knit)</u>	?	?		
i. <u>It's hard to find a good steak anymore</u> <u>(?It's hard to find a good steak still)</u>	?	?		
j. <u>It's easy to find a good steak anymore</u>	*	*		
k. <u>Calculators are cheap anymore</u>	*	*		

There is another hypothesis consistent with these facts about *anymore*. That is that innovating dialects have traded a necessarily narrow scope adverb for the necessarily wide scope adverb. This hypothesis is possible because the translation (21) operating on a sentence with wide scope negation will give the same result as (20) operating on a sentence with no negation. (*Anymore<sub>n</sub>* has as its scope the meaning of the sentence that it appears in minus its negation.)

I have chosen the two-lexical item approach here to account for my intuition (as a speaker of a positive *anymore* dialect) that (23a) is ambiguous, having the readings (23b) and (23c). The intuition involves the fact that *anymore<sub>w</sub>* differs from *anymore<sub>n</sub>* further in that it appears only in generic/habitual kinds of sentences. Hence (23a) is ambiguous for the innovating dialect between the single event reading (23b) and the dispositional reading (23c).

(23)a. *John isn't at home anymore*

b. (*anymore<sub>n</sub>*) Asserts: John isn't at home  
 Implicates: He was in the past

c. (*anymore<sub>w</sub>*) Asserts: John isn't at home habitually  
 Implicates: In the past, he was home  
 more often

The ambiguity of (23a) is corroborated by the fact that when *anymore* appears sentence initially (*anymore<sub>w</sub>*), the sentence has only the reading (23c). If we add an adverb which forces a non-habitual reading, we get the redundant but acceptable (and unambiguous) (24a). Since (24a) only has a reading with *anymore<sub>n</sub>*, the ungrammaticality of (24b) is predicted.

(24)a. *John isn't at home anymore now*

b. \**Anymore John isn't at home now*

While I cannot give a reason why *anymore*, should have this restriction, I suspect that it has something to do with the interval operator in its meaning. I also do not think that it is an accident that the sentences furthest down on the covert negation scale ((22f-i)) are also generic/habitual sentences.

4. To summarize, I have tried to show that by assuming a certain relation between semantic scope and order in surface form of negative words and sentence adverbs, and a semantics which distinguishes assertion from implicature, the meanings of sentences containing these adverbs can be accounted for compositionally. I have also tried to show that such a semantics can encompass the semantics of the negative polarity adverbs with the addition of a certain kind of restriction that is also useful in discussing the difference between dialects where *anymore* has different polarity properties.

#### FOOTNOTES

1. The interpretation given to the distinction between assertion and implicature in this semantic theory has the consequence that truth is based upon assertion alone and not implicature. Hence it will follow that *John is still at home* is technically true iff John is at home now regardless of whether he has been there for a while. The sentence does implicate that he has in fact been at home for a while, and would be inappropriately used unless it were true that he had been home for a while prior to Speech Time. Our usual intuition of 'true' will correspond to 'technically true and appropriately used in light of its conventional implicature'.

2. The labels on the ADV positions do not distinguish syntactic categories. There is only one syntactic category of sentence adverbs. They serve to abbreviate what would be two rules of a Montague grammar using a categorial syntax into one PS rule by allowing the translation to vary with syntactic position.

3. I am concentrating on scope relations with AUX negation, but the modals also seem to show the same ambiguities. Consider (i) which seems to be ambiguous between readings suggested by (ii) and (iii).

- (i) *John will/should still be at home*
- (ii) *It is still the case that John will/should be at home.*
- (iii) *It will/should be the case that John is still at home*

4. There is a sixth adverb position in negative sentences which is not dealt with by this rule. It is the position between the

first auxiliary and the *not* in *John is still not here*. It is also wide scope position (being to the left of the negation). Adverbs may appear here only when the first AUX is not simply *do*. I envision treating this case by a transformation which moves the adverb over the Auxiliary. It is comparable to the rule of Auxiliary Shift in Baker 1971.

5. There is a wide scope *yet* in some idiolects which is not dealt with here owing to space considerations. It is the *yet* of *John is here yet* and is synonymous with *still*. This item is dying out of the language, since most of its uses are either handled by the new negative polarity *yet* described here or taken over by the synonymous *still*.

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## APPENDIX

This appendix shows how the translations given above were derived. Below is a set of PS rules each of which has an associated translation rule which shows how the translation of the larger constituent is formed from the translations of its components. In the rules below, for any expression CON, CON<sup>e</sup>, CON<sup>i</sup>, and CON<sup>h</sup> stand for the extension expression of, implicature expression of, and value of the Heritage function for CON respectively.

Syntactic and Translation Rules

$$S \rightarrow (ADV_w)NP(ADV_w)Tns \text{ (not) } (ADV_n) VP (ADV_n)(ADV_w)$$

$$S^e = Tns^e[ADV_w^e(\text{not}^e(\text{ADV}_n^e(\text{NP}^e(\text{VP}^e))))]$$

$$S^i = Tns^i[ADV_w^i(\text{not}^e(\text{ADV}_n^e(\text{NP}^e(\text{VP}^e))))] \wedge$$

$$ADV_w^h(\text{ADV}_n^i(\text{NP}^e(\text{VP}^e)) \wedge$$

$$ADV_n^h(\text{NP}^i(\text{VP}^e) \wedge \text{NP}^h(\text{VP}^i))))]$$

$$NP \rightarrow N \quad NP^e = N^e, NP^i = N^i$$

$$VP \rightarrow V_i \quad VP^e = V_i^e, VP^i = V_i^i$$

$$V_t NP \quad VP^e = V_t^e(\text{NP}^e),$$

$$VP^i = \lambda x[V_t^i(\text{NP}^e)(x) \wedge V_t^h(\text{NP}^i)(x)]$$

$$Tns \rightarrow \{\text{Past}, \text{Present}\}$$

I also assume an NP quantification rule like that of PTQ or Cooper 1975 [Robin Cooper, Montague's Semantic Theory and Transformational Syntax, University of Massachusetts/Amherst Dissertation] and a rule of Do-Support as well as the following abbreviatory convention about translation rules for PS rules:

When a PS Rule contains an optional constituent whose translation is an expression of type  $\langle\langle s, \tau \rangle, t \rangle$  (for any  $\tau$ , a type) the translation rule is given for the maximal expansion of the PS Rule. The place of a missing optional constituent  $\delta$  in the translation rule is taken by the empty translation of the type of  $\delta$ 's translation. The empty translation is an identity function which contributes nothing to the assertion

assertion and passes through the implicatures of the remainder, and a constant function which prevents the introduction of any new implicature. That is,  $\delta$  translates  $\langle \lambda v \langle s, t \rangle \langle v \langle s, t \rangle \rangle; \lambda v \langle s, t \rangle x = x \rangle$ .  $\delta^h = \delta^e$ .

### Lexicon

CAT	Item	Extension Expr.	Implicature Expr.
ADV	<u>again</u>	$\lambda p \sim p$	$\lambda p$ ONCE-BEFORE $\sim p$
	<u>still</u>	$\lambda p \sim p$	$\lambda p$ Pi $\sim p$
	<u>anymore</u> <sub>n</sub>	$\lambda p \sim p$	$\lambda p$ Pi $\sim p$
	<u>anymore</u> <sub>w</sub>	$\lambda p \sim p$	$\lambda p$ Pi $\sim p$
	<u>yet</u>	$\lambda p \sim p$	$\lambda p [Pi \sim p \wedge$ H expected( $\sim p$ )]
	<u>necessarily</u>	$\lambda p \Box \sim p$	$\lambda p x = x$
Tns	Past	$\lambda p$ PAST $\sim p$	
	Present	$\lambda p \sim p$	
	<u>not</u>	$\lambda p \sim p$	
Name	<u>Cathy</u>	$\lambda PP \{^c\}$	Cathy <sup>i</sup>
Vi	<u>bid</u>	bid <sup>e</sup>	bid <sup>i</sup>

For each item here save Past and not,  $CON^e = CON^h$ .

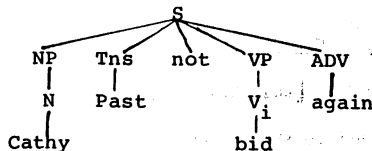
### New operators for Intensional Logic

Pi $\phi$  is true at m iff there is some interval prior to or ending at m over which  $\phi$  is true (and if  $\phi$  is true at m, m is in that interval).

PAST $\phi$  is true at m iff there is an interval prior to m at which  $\phi$  is true.

ONCE-BEFORE $\phi$  is true at m iff  $\phi$  is true at some time prior to m.

On the next page are the translations for the two readings of "Cathy didn't bid again".



- ADV<sub>n</sub>  $S^e \Rightarrow Tns^e(\wedge[ADV_w^e(\wedge not^e(\wedge ADV_n^e(\wedge NP^e(\wedge VP^e))))])$   
 $\lambda p \text{ PAST}^e p(\wedge[\lambda p^e p(\wedge not^e(\wedge again^e(\wedge Cathy^e(\wedge bid^e))))])$   
 $\text{PAST}[\lambda p^e p(\lambda p^e p(\lambda p^e p(\lambda p^e p(\wedge c)(\wedge bid^e)))]$   
 $\text{PAST}[\neg bid^e(\wedge c)]$
- S<sup>i</sup>  $\Rightarrow Tns^e(\wedge[ADV_w^i(\wedge not^e(\wedge ADV_n^e(\wedge NP^e(\wedge VP^e))))] \wedge$   
 $ADV_w^h(\wedge[ADV_n^i(\wedge NP^e(\wedge VP^e)) \wedge$   
 $ADV_n^h(\wedge[NP^i(\wedge VP^e) \wedge NP^h(\wedge VP^i)])])])$   
 b.  $\lambda p \text{ PAST} p(\wedge[\lambda p^e x=x(\wedge not^e(\wedge ADV_n^e(\wedge NP^e(\wedge VP^e))))] \wedge$   
 $\lambda p^e p(\wedge[again^i(\wedge Cathy^e(\wedge bid^e)) \wedge$   
 $\lambda p^e p(\wedge[Cathy^i(\wedge bid^e) \wedge$   
 $Cathy^h(\wedge bid^i)])])])$   
 c.  $\text{PAST}[x=x \wedge \lambda p \text{ ONCE-BEFORE } p(\wedge bid^e(\wedge c)) \wedge$   
 $[Cathy^i(\wedge bid^e) \wedge Cathy^h(\wedge bid^i)]]$   
 d.  $\text{PAST}[x=x \wedge [\text{ONCE-BEFORE } bid^e(\wedge c) \wedge$   
 $[Cathy^i(\wedge bid^e) \wedge Cathy^h(\wedge bid^i)]]]$

ADV<sub>w</sub>

- $S^e$
- a.  $Tns^e(\wedge[ADV_w^e(\wedge not^e(\wedge ADV_n^e(\wedge NP^e(\wedge VP^e))))])$
  - b.  $\lambda p \text{ PAST}^v p(\wedge[again^e(\wedge not^e(\wedge \lambda p^v p(\wedge Cathy^e(\wedge bid^e))))])$
  - c.  $PAST[\lambda p^v p(\wedge \lambda p^v p(\wedge \lambda p^v p(\wedge \lambda PP\{^c\}(\wedge bid^e))))]$
  - d.  $PAST[\neg bid^e(\wedge c)]$

- $S^i$
- a.  $Tns^e(\wedge[ADV_w^i(\wedge not^e(\wedge ADV_n^e(\wedge NP^e(\wedge VP^e)))) \wedge$   
 $ADV_w^h(\wedge[ADV_n^i(\wedge NP^e(\wedge VP^e)) \wedge$   
 $ADV_n^h(\wedge[NP^i(\wedge VP^e) \wedge$   
 $NP^h(\wedge VP^i)])])])$
  - b.  $\lambda p \text{ PAST}^v p(\wedge[again^i(\wedge not^e(\wedge \lambda p^v p(\wedge Cathy^e(\wedge bid^e)))) \wedge again^h(\wedge \lambda p^v p(\wedge Cathy^e(\wedge bid^e)) \wedge \lambda p^v p(\wedge[Cathy^i(\wedge bid^e) \wedge Cathy^h(\wedge bid^i)]))])])$
  - c.  $PAST[\lambda p \text{ ONCE-BEFORE}^v p(\wedge not^e(\wedge Cathy^e(\wedge bid^e)) \wedge \lambda p^v p(\wedge[x=x \wedge [Cathy^i(\wedge bid^e) \wedge Cathy^h(\wedge bid^i)]))])]$
  - d.  $PAST[ONCE-BEFORE \lambda p^v p(\wedge \lambda PP\{^c\}(\wedge bid^e)) \wedge [x=x \wedge [Cathy^i(\wedge bid^e) \wedge Cathy^h(\wedge bid^i)]]]$